IKO / GL
Industries LTD.

FIELD PROCESS QUALITY CONTROL PLAN

IKO/GL ARMOURBRIDGE

- The intent of this Field Process Quality Control Plan (FPQCP) is to serve as reference for the inspectors and applicators alike.

- This FPQCP is a step-by-step tool to be used in accordance with the special provision section 538.5 and 538.6 of the NHDOT standard specifications for road and bridge construction. In the case of conflict between this report and NHDOT specifications the latter shall prevail unless prior written approval is provided by the engineer.

- This FPQCP is also to be used with IKO/GL Quality Control Report and IKO installation guidelines **(attached).**

- ARMOURBRIDGE membrane will only be applied by IKO/GL certified applicators with photo ID. This ID badge will be valid for a period of (2) years and will mention the applicator's name and the type of activity he is certified for.

- In the event of conflict between this document and NHDOT specifications, NHDOT specifications govern.

Submitted by IKO / GL

Signature: _____ June 18th, 2009

Bertrand Lefebvre, Authorized Representative.

NHDOT APPROVAL

Signature: _____ Date 6-18-09

1. **GENERAL:**

SAFETY

- All work performed including loading and unloading shall be made to insure the safety of all in working area.
- All workers shall use the required personal protection equipment.
- No open flame should be used less than 30 feet of uncured primer.
- When 160 yard rolls are used, never stand under during loading process.

STORAGE AND HANDLING

- Material shall be identified with name and lot number.
- Material shall be protected against prolonged exposure to sun (>1 week). Use light colored tarps or original wrapping.
- Propane tanks shall be secured at the end of the day.
- All construction debris shall be removed from site.

2. **SURFACE PREPARATION**

Bridge deck shall be clean, free of sharp edges or other protrusions.

- This is verified by visual survey
- Give special attention for nails and other debris left embedded in concrete.

Bridge deck shall be free of laitance, oil, and other foreign materials that are detrimental to the adhesion of IKO/GL membrane.

- This is verified by visual survey once the shot blast and/or sandblast is completed.
- Surface preparation must be to the satisfaction of the Engineer and IKO/GL representative before any primer could be installed.
- Tightly Adhered bitumen based material remaining on deck after shotblast is acceptable if each area is less than 1sq. ft. (900cm^2), totally adhered, and represents less than 5% of any 100sq.ft. (9M^2).

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Bridge deck shall have less than 6 % moisture content

- Use a NHDOT approved calibrated moisture meter, certificate of calibration is available to the engineer.
- A minimum of 10 readings is required.
- Note in IKO/GL QC sheet, the low and high value.

Bridge deck tensile bond shall be a minimum of 100 PSI.

- IKO/GL applicator shall glue with adhesive CWI or equivalent one dolly per 400 m^2 or 500 y^2 (minimum 3 per structure). Glue should be applied on the shotblasted deck and on the dolly. Full contact between dollies and structure has to be obtained with the glue.
- Use Elcometer tensile bond tester for this procedure.
- Note in QC sheets all results.
- This testing procedure is only needed when requested in the specifications.

3. PRIMER APPLICATION

- Product to be used shall be listed on the NHDOT Qualified Products List.
- Do not use any open flame near freshly applied product.
- The primer could be sprayed, rolled or brushed to the deck.
- The coverage can vary due to the porosity of the deck.
- Range shall be 125 to 300 sq ft. per gallon. The deck will absorb the primer at different rate. Difference in shade is normal but very light or pale area should be primed again.
- Prevent build-up by rolling and spreading and accumulation.
- Once dry, no tracking should be visible. Check by twisting your foot on the primed surface.
- Note in IKO QC sheet quantity of primer used and batch number on the container.

Special precautions shall be taken if there is oil-stained area on the concrete deck. Washing with mineral spirits or acetone could be done; the area should feel dry and not oily.

4. MEMBRANE APPLICATION

- Armourbridge membrane shall be installed starting at the low point of the deck (generally where drains are located.)
- Membrane has to be staggered not to have 2 adjacent end rolls at the same point. (Minimum distance shall be 2 feet).
- For "Machine Method" application, a first strip near the curbs is welded by hand where machine cannot reach.
- When welding machine is used, all end rolls shall be roll back and weld by hand.
- Each roll to be welded by torch shall be unrolled and placed in its proper final position. It should be rolled from each end up to the middle.
- The membrane shall be totally welded to the deck.
- The appropriate torch for this work shall be very light with a pilot fire and a hand control release valve. (Suggested type is Model NESTA) A shorter version is available for detailed work
- Present flames to all surfaces including already installed membrane where overlap is to be welded.
- Too much heat is better than not enough. (Do not burn polyester fabric).
- Each end lap shall overlap 6"inches.
- Each edge(side) lap shall overlap 3"inches.
- Stay within 1inch (2.5 cm) of any curb, drain, expansion joint or other vertical obstacle.
- An additional 6" (150mm) strip shall be installed on the center of outside corners at down turns prior to the installation the membrane.
- Cut a 3" x 3" triangle at end roll of the lower ply of membrane if not done at IKO plant. This is to diminish the overlap thickness.
- Reheat and seal all edges not fully adhered to the deck or to the membrane underneath.
- If irregularities are found on the deck, melted bitumen could be used to fill them. You could use either the heated bitumen from the underside of IKO's Armourbridge membrane or hot rubberized asphalt as per Item 538.4 on the approved list.
- Embedded ceramic granules by heating the surface where overlap is to be welded if not done at IKO plant.

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4. Cont.

- It is not important if overheating discolors the topside of membrane.
- A small bead of melted bitumen is good to see coming out of the sides of the roll. This is not mandatory since the ends of each roll does not have sufficient weight from the roll itself to press the bitumen out. It is also not visible in the middle of the roll since the heat is just starting and there is no build-up of melted bitumen.
- At the end of each day, all edges and overlaps shall be checked. Any area not fully welded shall be sealed by using heat and pressure from a trowel.
- A visual inspection has to be made by IKO rep and the inspector to assure overlaps are fully welded.

5. **EDGING**

- To assure waterproofed edges, hot rubberized asphalt shall be use to seal at curb lines, expansion joints, drain and other obstacle.
- Make sure the liquid membrane seals all the underside of the membrane if substrate profile did not allow full contact with the welded membrane.
- All irregularities shall be filled.
- IKO doesn't recommend an extra 6" (150mm) around the edges, drain, or expansion joints. It is recommend to use hot rubberized asphalt (NHDOT PRODUCT LIST) or to use melted bitumen from the underside of Armourbridge membrane to seal the edges. Applicator shall use a trowel to hold strip of membrane and to push the melted bitumen into position.

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6. TACK COAT APPLICATION

- Product to be used is the same as per the primer application, or a preferred product is the tack coat applied to a bituminous concrete surfaces.
- If the bituminous concrete tack coat is used it shall conform to the requirements of AASHTO M 140 or 208 and to NHDOT standard specification section 410.
- If the solvent based primer is used follow the 4 items for application guidelines.
    1. Use as little as possible not to impregnate solvent in the membrane. (Coverage shall be 250 to 500 sq. feet per gallon.)
    2. Do not let any accumulation stay over the installed membrane.
    3. A slight change of color indicates there is enough.
    4. Roller or spray application is acceptable.
- Make sure there is no dust or debris prior to applying the tack coat.
- Make sure the surface stays clean until asphalt overlay is installed
- The surface shall be paved within seven (7) days after the application of tack coat.

7. REPAIRS

- Any area where there is no bond, including blisters, shall be cut open and the unbonded material shall be removed.
- Use knives with curved blades to cut membrane
- Heat a minimum of 4" all around the area and degranulate the top surface.
- Install a new Armourbridge membrane with the help of a trowel and seal the edges.
- Check for bond of the repaired area by tapping with the trowel handle. A distinctive hollow sound is produced where there is a lack of bond.
- If contaminants such as gasoline, oil, or other are spilled on membrane, repeat the above procedures.
- Blisters occurring just before paving or once hot pavement is installed, shall be punctured using a hot pick at 45° thru the hot pavement if necessary.

8. TROUBLESHOOTING

- **PROBLEM: Irregularity of the deck at curb lines and along the expansion joints.**
  When the profile or voids cannot be filled by the melted bitumen, a larger than 1" (2.5cm) should be left without Armourbridge membrane. Hot rubber membrane could be applied on the unprotected area. This procedure can only be done with the approval of IKO representative and Engineer.
- **PROBLEM: Not sufficient heat output or inconsistent supply of fire at the torch.**
  This is normally caused by the propane freezing in tank or by small debris at the nozzle. This is easily repaired by cleaning the orifice or by changing tank.
- **PROBLEM: Middle of the roll not welded.**
  This happens when the worker doesn't push back the half roll not yet welded after the first half is installed. Use repair procedures.
- **PROBLEM: Deck with profile exceeding minimal requirement.**
  When such situation occurs, the Engineer shall give directives to the contractor. Some acceptable options may require the use of the automated welding machine, the use of hot-rubberized asphalt or the application of asphalt cement prior to the use of IKO ARMOURBRIDGE Membrane.
- **For any situation affecting the performance of IKO ARMOURBRIDGE, contact IKO/GL Representative.**

PART 1 – GENERAL

1.1 SUMMARY

.1 This section specifies the minimum criteria for supplying and installing the waterproofing membrane over bridge deck.

1.2 REFERENCES

The following is a listing of the publications referenced in this section:

- American Association of State Highway and Transportation Officials (AASHTO)

AASHTO MPQ	Performance graded asphalt binder
AASHTO PP1	Practice for accelerated aging of asphalt binder using a pressurized aging vessel (PAV)
AASHTO TP1	Test method for determining the flexural creep stiffness of asphalt binder using the bending beam rheometer (BBR)
ASSHTO TP5	Test method for determining the rheological properties of asphalt binder using a dynamic shear rheometer (DSR)
AASHTO T48	Flash and fire points by Cleveland Open Cup
ASSHTO T240	Effect of heat and air on a moving film of asphalt (Rolling thin film oven test)

- American Society for Testing and Materials (ASTM)

ASTM D 36	Softening point of bitumen (ring and ball apparatus)
ASTM D 451	Test method for sieve analysis of granular mineral surfacing of asphalt roofing products
ASTM D 5976	Type I polymer modified asphalt cement for use in pavement construction
ASTM D 6084	Method for elastic recovery of bituminous materials by ductilometer
ASTM D 4073	Tensile-tear strength of bituminous membranes
ASTM D 5147	Sampling and testing modified bituminous sheet material
ASTM D 96	Water vapor transmission of materials

1.3 RELATED WORK (not included in this section)

.1 Surface Preparation
.2 Expansion Joint
.3 Concrete repairs
.4 Asphalt concrete

1.4 WATERPROOFING CONTRACTORS QUALIFICATIONS

.1 The waterproofing sub-contractor shall be an authorized applicator from the manufacturer.
.2 The sub-contractors supervisor shall have a minimum of five (5) years experience in bridge waterproofing.
.3 The sub-contractor shall be ISO 9002 certified (total quality system) or has been implementing a total quality system for at least two (2) years.
.4 Quality control sheet shall be submitted for approval by the engineer.

1.5 ACCEPTABLE SUBSTRATES

.1 New poured deck shall cure a minimum of fourteen (14) days.
.2 Substrate shall be free of excessive moisture.
.3 Substrate shall be free of sharp edges or ridges.
.4 Concrete surfaces shall be free of curing agent, oil, fuel, etc.
.5 Concrete repairs shall be done accordingly to section _____. (New material shall cure to have less than 5% relative humidity).
.6 Surface preparation should be done in accordance to section_____.

1.6 STORAGE AND HANDLING

.1 Store the material above freezing temperature.
.2 Keep material in original protective wrapping with identification numbers.

PART 2 – PRODUCT

The waterproofing membrane system shall be "Armourbridge" manufactured by IKO Industries (IKO), Sumas, Washington. Distributed by Groupe Lefebvre 1-(888) 491-6444.

2.1 PRIMER

.1 The primer shall be Armourbridge primer WB/SB or equivalent approved by IKO and the engineer.
.2 Primer shall meet the ASTM D41 and CGSB 37 GP-9.

2.2 MEMBRANE

.1 The membrane shall consist of a strong reinforcing polyester mat which is saturated and coated on both sides with SBS modified bitumen.
.2 The membrane shall be "Armourbridge" from IKO.
.3 The upper side shall be protected by ceramic granules.
.4 The under side shall be covered with a polyethylene burn off film.

2.3 LIQUID MEMBRANE (EDGE DETAIL)

.1 The liquid membrane shall be approved in writing by the membrane manufacturer.
.2 The liquid membrane shall comply with ASTM 5142 SEBS requirements.
.3 The liquid membrane shall be SBS modified bitumen.

2.4 COLD ADHESIVE (EDGE DETAIL)

.1 The cold adhesive shall be approved in writing by the membrane manufacturer.
.2 The cold adhesive shall comply with ASTM D 3019 tye III or CGSB-37-GP-8 requirements.

2.5 CONCRETE ASPHALT OVERLAY (For information only)

.1 The asphalt overlay shall be at least 60mm (2-3/8") in thickness (road and highway).
.2 The asphalt overlay shall be at least 40 mm (1-1/2") in thickness (indoor parking and plaza).

PART 3 – EXECUTION

3.1 PREPARATION (for information only)

.1 Shot blast or abrasive blast shall be done according to section_____.

3.2 APPLICATION OF PRIMER

.1 Apply one coat of primer at a rate of 4 to 6 square meters per liter (165 to 245 square feet per gallon) unless modified by the membrane manufacturers representative and approved by the engineer.
.2 The application can be made by brush, roller or sprayer.
.3 Prevent pounding in low areas.
.4 Primer shall be tack free in accordance with manufacturer's recommendations prior to application of the waterproofing membrane.

3.3 APPLICATION OF WATERPROOFING MEMBRANE

.1 Start the installation of membrane at low side of structure.
.2 Side overlap shall be 75 mm, ±10 mm.
.3 Membrane strips parallel to curb shall be welded by torch.
.4 End overlap shall be a minimum of 150 mm.
.5 The application of waterproofing membrane shall be done using a self-propelled vehicle to assure consistant welding.
.6 The mechanical application is required when surface to be waterproofed exceeds 500 square meters (5380 square feet).
.7 Verify each joint when membrane is installed.

3.4 REPAIR OF WATERPROOFING MEMBRANE

.1 Damaged waterproof membrane shall be patched in accordance with the manufacturer's recommendations.
.2 Any blisters found in the applied waterproof membrane shall be punctured with a torch heated pick, prior to paving or at time of paving.

3.5 EDGING DETAIL

.1 Apply the liquid membrane or the cold adhesive to all vertical/horizontal transition to the membrane.
.2 Apply the material to overlap a minimum of 25mm (1") on the membrane and 12mm (1/2") on the vertical surface.

IKO TECHNICAL DATA SHEET

STOCK NO. 7930005 **APRIL, 2001**

ARMOURBRIDGE (200 M)

THIS PRODUCT CONSISTS OF A DURABLE, NON-WOVEN POLYESTER REINFORCING MAT THAT IS COATED AND IMPREGNATED WITH MODIFLEX SBS MODIFIED BITUMEN TO A SUPERIOR THICKNESS OF APPROXIMATELY 4.5 mm (177 mils). CERAMIC COLORED MINERAL GRANULES ARE EMBEDDED IN THE SURFACE TO PROVIDE PROTECTION AGAINST ABRASION AND WORK TRAFFIC, AND A LIGHT POLY FILM IS BONDED TO THE UNDERSIDE (WHICH DISAPPEARS UPON TORCH WELDING). ARMOURBRIDGE (200 M) IS SPECIFICALLY DESIGNED FOR HIGH EFFICIENCY BRIDGE DECK WATERPROOFING. THIS PRODUCT WILL EASILY SATISFY THE REQUIREMENTS OF CGSB-37.56-M FOR CLASS G, TYPE 2, GRADE 2 MATERIALS AS WELL AS THE REQUIREMENTS OF ASTM D6164 FOR TYPE I, GRADE G MATERIALS.

CHARACTERISTIC	UNITS	TYPICAL VALUE	SPECIFICATION	STANDARD LIMITS	TEST METHOD***
WEIGHT:	kg/m^2 (lb/ft^2)	5.3 (3.5)	-	*	-
LENGTH:	m (ft)	Up to 200 (656)	-	+/- 1%	-
WIDTH:	mm (in)	1000 (39.4)	-	+/- 3 (1/8)	-
THICKNESS:	mm (mils)	4.5 (177)	-	+/- 0.4 (16)	-
MAT WT.:	g/m^2 ($lb/100\ ft^2$)	180 (3.7)	-	-	-
SELVAGE:	mm (in)	90 (3.5)	-	+/- 5 (1/4)	-
COLD FLEX:	°C (°F)	-20 (-4)	ASTM D6164	MIN: -18 (0)	ASTM D5147
TENSILE STRENGTH MD: XD:	KN/m (lbf/in)	16 (91) 13 (74)	ASTM D6164	8.8 (50)	ASTM D5147
ULTIMATE ELONGATION (MD/XD):	%	60/70	ASTM D6164	35	ASTM D5147
TEAR STRENGTH MD: XD:	N (lbf)	74 (17) 81 (18)	CGSB-37.56-M	MIN: 20 (4.5)**	CGSB-37.56-M
TENSILE-TEAR MD: XD:	N (lbf)	377 (85) 511 (115)	ASTM D6164	246 (55)	ASTM D5147
LAP STRENGTH MD: XD:	KN/m (lbf/in)	16 (91) 13 (74)	CGSB-37.56-M	MIN: 4 (23)	CGSB-37.56-M
GRANULE LOSS:	g	0.4	ASTM D6164	MAX: 2.0	ASTM D5147
STATIC PUNCTURE:	N (lbf)	≥ 300 (67.5)	CGSB-37.56-M	≥ 150 (34)**	CGSB-37.56-M

* OPTIMUM PERFORMANCE BASED ON THICKNESS, NOT WEIGHT.

** CGSB-37.56-M REVISION, 8TH DRAFT, DATED OCTOBER, 1996.

*** ALTHOUGH BOTH ASTM AND CGSB MAY HAVE REQUIREMENTS FOR A PARTICULAR TEST, ONLY THE MORE STRINGENT IS INDICATED.

IKO/GL DATE: _____

QUALITY CONTROL

For Armourbridge System

Project Name: _____

Owner: _____ Project Engineer: _____

IKO/GL applicator: _____ Project Manager: _____

General Contractor: _____ Project Manager: _____

Specific Location: _____ Project Number: _____

Consultant: _____ Technician: _____

Temperature: Minimum: _____°C or F Maximum_____°C or F
Weather: AM_____ PM_____
Wind: AM_____ PM_____
Deck: Concrete NEW_____ Concrete OLD_____ Other_____
Surface prep: _____
Shotblast or/and Sandblast: Yes _____ No_____
Deck Humidity: From _____% to _____%
Deck Temperature: Morning _____°C or F Afternoon _____°C or F
Deck Profile: Smooth _____Porous____ Irregular _____ Some Sharp Edges_____
General Conditions:_____
Primer Type: _____ Batch# _____Rate: _____
Membrane Type: Armourbridge _____ Batch# _____
Tackcoat: Yes___ No:____ Type: _____ Batch#:_____ Rate:_____
Curb sealant: Hot _____ Cold_____ Type_____Batch#:_____
GL-Mac Welding unit: _____ _____ _____

GENERAL SITE OBSERVATION

Primer dry to touch before welding:	Yes __	No __
Minimum side lap 3"(75mm)	Yes __	No __
Minimum end lap 6"(150mm)	Yes __	No __
Minimum end lap offset 24"(300 mm)	Yes __	No __
Visible melted bitumen under roll	Yes __	No __
Visible bitumen head at joint	Yes __	No __
Lap of curb sealant on membrane min. 1"(25cm)	Yes __	No __
Overlaps checked	Yes __	No __
Membrane was installed properly	Yes __	No __

OTHER:_____

_____

_____

IKO/GL Representative signature:_____

Owner or Consultant signature: _____

Applicator signature: _____

This QC sheet can be duplicated for Owner, Consultant, Applicator or GC.

Rev.11-07